

WATER POSSIBILITIES FROM THE
GLACIAL DRIFT OF
CHARITON COUNTY

BY

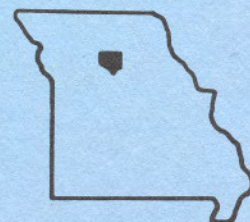
DALE L. FULLER

JAMES MARTIN

HARRY PICK

W. B. RUSSELL

JACK S. WELLS



Water Resources Report 12

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OF CHARITON COUNTY

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Dale L. Fuller, James Martin, Harry Pick,
W. B. Russell, and Jack S. Wells



1957

STATE OF MISSOURI
Department of Business and Administration
Division of
GEOLOGICAL SURVEY AND WATER RESOURCES
Thomas R. Beveridge, State Geologist
Rolla, Missouri

WATER POSSIBILITIES FROM THE GLACIAL DRIFT OF CHARITON COUNTY

A special study of groundwater by the Missouri Geological Survey and Water Resources was made possible at the 1955 session of the Missouri Legislature. With the approval of the Governor, money was appropriated from the Missouri Post War Surplus Reserve Fund.

Since nearly two-thirds of the counties located north of the Missouri River are deficient in water supplies, much of the effort of this special study is being directed toward the problems of this area.

It has been shown that a program of test drilling can locate new reserves of groundwater. Potential areas are being tested so that additional supplies will be available for domestic, irrigation, industrial and municipal needs.

The most favorable areas are in the sand and gravel filled channels and valleys of pre-glacial and inter-glacial streams. Since these buried valleys do not conform to present day drainage patterns, a systematic program of test drilling is a principal means of locating the channels and mapping their extent. Such glacial deposits have proved to be excellent sources of groundwater.

QUALITY OF WATER FROM ROCK WELLS

The water from the consolidated rock formations which underlie Chariton County is, for the most part, mineralized. The following are analyses from water wells and oil tests.

CONSTITUENTS	IN PARTS PER MILLION				
	A	B	C	D	E
Turbidity	turbid	80.0			
Odor	mouldy	none	H ₂ S	H ₂ S	
pH		8.5			
Alkalinity (CaCO ₃)	293.0	276.0			251.0
Phenolphthalein		0			
Methyl Orange		276.0			
Carbonate (CO ₃)	0.0	0	0.0		144.1
Bicarbonate (HCO ₃)	357.3	335.9	272.0	588.9	34.7
Silica (SiO ₂)	6.4	6.0	12.0	4.9	45.8
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	0.91*				
Calcium (Ca)	324.8	434.4	726.7	729.6	
Magnesium (Mg)	164.5	224.2	303.9	324.3	223.1
Sodium (Na) and Potassium (K) as Na	2490.2	3426.5	4526.0 ¹	4638.4 ¹	3237.0
Total Manganese (Mn)					
Total Iron (Fe)	10.20	0.14			
Dissolved Iron	0.20				
Precipitated Iron	10.00				
Sulfate (SO ₄)	1306.3	1306.3	1415.6	1286.2	1371.2
Chloride (Cl)	3690.5	5292.0	8029.0	8113.2	5240.6
Nitrate (NO ₃)	0.22	0	0.0		
Fluoride (F)	4.0				
Total Suspended Matter	44.0				
Total Dissolved Solids	8976.0	12225.0		15682.4	
Total Hardness	1486.5	2005.0	2389.9	3153.6	1895.2
Carbonate Hardness	293.0	276.0			
Non-carbonate Hardness		1729.0			
Percent of Alkalies	78	79	76	76	

*Al₂O₃ only
¹ Sodium (Na)

A. Owner: W. M. Brunk, SW 1/4 NW 1/4 SW 1/4 sec. 19, T. 55 N., R. 19 W. Bottomed in Burlington formation of the Mississippian System at a total depth of 403 feet. 323 feet of casing. Yield 11 gallons per minute, static water level 76 feet. Analyzed June 17, 1936 by R. T. Rolufs.

B. Owner: Prairie Hill School; SW 1/4 SW 1/4 sec. 32, T. 55 N., R. 16 W. Bottomed in Burlington-Keokuk formation of the Mississippian System at a total depth of 410 feet. Static water level 65 1/2 feet. 220 feet of casing. Analyzed May 19, 1950 by the Missouri Division of Health.

C. Owner: City of Triplett, SW 1/4 NE 1/4 NE 1/4 sec. 18, T. 54 N., R. 20 W.
Total depth 1475 feet. The well flows. Analyzed by Paul Schweitzer.

D. Owner: City of Brunswick, NW 1/4 SW 1/4 sec. 2, T. 53 N., R. 20 W.
Total depth 1505 feet. Yield 6 gallons per minute. 700 feet of casing. Well flowed.
Temperature 53° F. Analyzed by Paul Schweitzer.

CONSTITUENTS	IN PARTS PER MILLION				
	F	G	H	I	J
Turbidity	turbid	turbid	turbid	turbid	turbid
Odor					
pH					
Alkalinity (CaCO ₃)	124.1	197.3	239.0	214.4	228.3
Phenolphthalein					
Methyl Orange					
Carbonate (CO ₃)	0.0	0.0	0.0	0.0	0.0
Bicarbonate (HCO ₃)	151.4	240.6	291.5	261.5	278.4
Silica (SiO ₂)	34.8	6.8	9.6	7.2	13.6
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	4.00 ^a	2.00 ^a	1.20 ^a	2.00 ^a	3.20 ^a
Calcium (Ca)	22.5	374.8	490.1	501.7	464.7
Magnesium (Mg)	8.6	180.4	234.0	255.7	197.8
Sodium (Na) and Potassium (K) as Na	26.1	2576.8	3424.5	3650.8	3145.2
Total Manganese (Mn)					
Total Iron (Fe)					
Dissolved Iron					
Precipitated Iron					
Sulfate (SO ₄)	18.7	890.3	1189.6	1259.4	1281.2
Chloride (Cl)	6.0	4421.4	5717.4	5870.8	4898.5
Nitrate (NO ₃)					
Fluoride (F)	0.20			5.00	4.00
Total Suspended Matter					
Total Dissolved Solids	253.0	9889.0	13341.0	12968.0	12000.0
Total Hardness	91.5	1676.6	2184.7	2302.6	1972.7
Carbonate Hardness	91.5	197.3	239.0	214.4	228.3
Non-carbonate Hardness					
Percent of Alkalies	38	77	77	78	78

^aAl₂O₃ and Fe₂O₃

E. Owner: Charles Thrash, NW 1/4 NW 1/4 NW 1/4 sec. 4, T. 53 N., R. 18 W.
Bottomed in the Mississippian System at a total depth of 218 feet. Analyzed June 12, 1905

F. Owner: Frank Buttram, Vance Bros., farm, NW 1/4 SE 1/4 NE 1/4 sec. 35, T. 53 N., R. 18 W. Total depth 919 feet. Bottomed in Cotter formation of the Ordovician System. Sample from depth of 205 feet at the contact between the Cherokee of the Pennsylvanian System and the Ste. Genevieve formation of the Mississippian System. Analyzed July 29, 1939 by R. T. Rolufs.

G. As above. Sampled from Burlington-Keokuk formation of the Mississippian System at a depth of 368 feet. Analyzed July 29, 1939 by R. T. Rolufs.

H. As above. Sample from depth 395 to 400 feet, Keokuk-Burlington formation, Mississippian System. Analyzed July 29, 1939 by R. T. Rolufs.

CONSTITUENTS	IN PARTS PER MILLION		
	K	L	M
Turbidity	turbid	turbid	turbid
Odor			
pH			
Alkalinity (CaCO ₃)	198.3	164.9	147.6
Phenolphthalein			
Methyl Orange			
Carbonate (CO ₃)	0.0	0.0	0.0
Bicarbonate (HCO ₃)	241.8	201.1	180.0
Silica (SiO ₂)	9.2	8.8	4.4
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	2.80 ^a	2.40 ^a	16.00 ^a
Calcium (Ca)	466.9	435.0	424.9
Magnesium (Mg)	230.3	203.4	201.1
Sodium (Na) and Potassium (K) as Na	3400.9	3253.4	3017.4
Total Manganese (Mn)			
Total Iron (Fe)			
Dissolved Iron			
Precipitated Iron			
Sulfate (SO ₄)	1193.8	1281.6	1266.0
Chloride (Cl)	5593.0	5185.6	5063.6
Nitrate (NO ₃)			
Fluoride (F)	3.75	5.00	
Total Suspended Matter			
Total Dissolved Solids	12914.0	11867.0	11578.0
Total Hardness	2111.5	1921.4	1886.8
Carbonate Hardness	198.3	164.9	147.6
Non-carbonate Hardness			
Percent of Alkalies	78	79	78

^aAl₂O₃ and Fe₂O₃

I. As above. Sample from 561 feet, Chouteau formation, Mississippian System. Static water level 95 feet. Analyzed September 5, 1939 by R. T. Rolufs.

J. As above. Sample from 765 feet, St. Peter formation, Ordovician System. Analyzed September 5, 1939 by R. T. Rolufs.

K. As above. Sample from 790 feet, St. Peter formation, Ordovician System. Analyzed September 5, 1939 by R. T. Rolufs.

L. As above. Sample from 835 feet, Cotter formation, Ordovician System. Static water level 110 feet. Analyzed September 13, 1939 by R. T. Rolufs.

M. As above. Sample from total depth at 919 feet from Cotter formation, Ordovician System. Static water level 112 feet. Analyzed August 18, 1939 by R. T. Rolufs.

Referring to Plate 1, it will be noted that a large area of Chariton County is unfavorably located to obtain water from glacial drift. Wells drilled into the consolidated rock to moderate depths may possibly obtain limited yields of water of marginal quality. The water from "rock" wells in all probabilities will become more mineralized with increased depth of drilling.

QUALITY AND QUANTITY OF WATER FROM STREAMS

All five water samples from streams were collected during a period of low stream flow. These analyses may be used only to show quality of water to be expected at times of low water.

CONSTITUENTS	IN PARTS PER MILLION				
	I	II	III	IV	V
Turbidity	150	80	25	15	6
Odor	none	bad	none	none	none
pH	8.1	6.9	8.1	8.25	6.9
Alkalinity (CaCO ₃)	147.5	127.5	188.5	188.5	78.5
Phenolphthalein	0.0	0.0	18.0	0.0	0.0
Methyl Orange	147.5	127.5	170.5	188.5	78.5
Carbonate (CO ₃)	0.0	0.0	10.8	0.0	0.0
Bicarbonate (HCO ₃)	180.0	155.6	208.0	230.0	95.8
Silica (SiO ₂)	5.4	8.2	6.2	6.2	7.4
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	0.6	6.8	1.4	0.8	7.6
Calcium (Ca)	48.1	36.5	61.9	62.5	64.5
Magnesium (Mg)	9.1	8.7	13.0	13.3	20.0
Sodium (Na) and Potassium (K) as Na	14.9	16.2	16.4	18.4	17.8
Total Manganese (Mn)	0.00	0.00	1.39	1.21	4.66
Total Iron (Fe)	2.24	6.68	1.06	1.03	1.75
Dissolved Iron	0.08	2.76	0.13	0.12	0.77
Precipitated Iron	2.16	3.92	0.93	0.91	0.98
Sulfate (SO ₄)	20.7	13.4	43.6	42.3	182.1
Chloride (Cl)	9.0	11.8	5.0	7.5	11.8
Nitrate (NO ₃)	0.9	0.0	0.0	0.0	0.0
Fluoride (F)	0.6	0.5	0.2	0.1	0.4
Total Suspended Matter	54.	53.	15.	14.	16.
Total Dissolved Solids	210.	216.	273.	275.	396.
Total Hardness	157.6	127.0	208.1	210.8	243.4
Carbonate Hardness	147.6	127.5	188.5	188.5	78.5
Non-carbonate Hardness	10.1		19.6	22.3	164.9
Percent of Alkalies	17	22	15	16	14

I Grand River, Sec. 4, T. 53 N., R. 20 W. Collected October 26, 1955.
Temperature of water 60° F., of the air 66° F. Analyst: M. E. Phillips.

II Mussel Fork at Keytesville, Sec. 4, T. 53 N., R. 18 W. Collected November 21, 1955. Color of water was black. Water conditions were killing the fish. Temperature of the water 44° F., of the air 64° F. Analyst: M. E. Phillips.

III Chariton River, Sec. 18, T. 54 N., R. 17 W. Collected November 21, 1955.
Temperature of the water 48° F., of the air 66° F. Analyst: M. E. Phillips.

IV Chariton River, Sec. 15, T. 53 N., R. 18 W. Collected November 21, 1955.
Temperature of the water 43° F., of the air 62° F. Analyst: M. E. Phillips.

V East Fork Chariton River, Sec. 5, T. 52 N., R. 17 W. Collected November 21, 1955. Temperature of the water 38° F., of the air 53° F. Analyst: M. E. Phillips.

Of the streams flowing within or bordering Chariton County, only the Missouri River has flow during low water adequate for irrigation.

The following are stream flow data from: Bolon, Harry C., Surface Waters of Missouri; Missouri Geological Survey and Water Resources, 2d ser., Vol. 34, pp. 219, 316, 379, 390 and 398, 1952.

Missouri River at Waverly

Location. -- Water-stage recorder, lat. $39^{\circ} 12' 51''$, long. $93^{\circ} 30' 57''$, in sec. 14, T. 51 N., R. 24 W., at bridge on U. S. Highway 65 at Waverly. Datum of gage is 645.49 feet above mean sea level, datum of 1929. From June 14, 1943 to Sept. 15, 1944, wire-weight gage at same site and datum.

Drainage Area. -- 491,200 square miles.

Records Available. -- March 1929 to September 1949.

Average Discharge. -- 20 years, 44,040 second-feet.*

Extremes. -- 1929-49: Maximum discharge, 347,000 second-feet Apr. 24, 1944; maximum gage height, 25.14 feet June 24, 1947; minimum discharge about 1,700 second-feet Jan. 9, 1940; minimum gage height 0.4 foot (present datum) Jan. 12, 1930.

Remarks. -- Records good 1940, 41, 49; excellent, 1942-48, except those for periods of ice effect, which are fair to good. Drainage basin above station contains many reservoirs with total usable capacity in excess of 27,640,000 acre-feet.

Cooperation. -- Station maintained by U. S. Geological Survey in cooperation with Corps of Engineers. Gage-height record collected in cooperation with U. S. Weather Bureau.

*One second-foot equals 448.83 gallons per minute.

Grand River Near Sumner

Location. -- Water-stage recorder, lat. $39^{\circ} 38' 25''$, long. $93^{\circ} 16' 25''$, in NE 1/4 sec. 29, T. 56 N., R. 21 W., at Chicago, Burlington & Quincy Railroad bridge, 2 miles southwest of Sumner and 2 1/2 miles downstream from Locust Creek. Datum of gage is 630.87 feet above mean sea level, datum of 1929. Auxiliary staff gage 3 1/4 miles downstream. Datum of auxiliary gage is 631.00 feet above mean sea level, datum of 1929. From Apr. 1, 1940 to Aug. 4, 1942, the auxiliary gage was 4 miles downstream.

Drainage Area. -- 6,880 square miles.

Records Available. -- April 1924 to September 1949.

Average Discharge. -- 25 years, 3,850 second-feet.

Extremes. -- 1924-49: Maximum discharge, 180,000 second-feet June 7, 8, 1947 (gage-height, 39.5 feet, from floodmark); minimum observed, 10 second-feet Aug. 12, 1934.

Flood of July 9, 1909 reached a stage of 36.7 feet, from floodmark.

Remarks. -- Records fair except those periods of ice effect, which are poor.

Cooperation. -- Station maintained by U. S. Geological Survey in cooperation with Corps of Engineers.

Yellow Creek near Rothville, Chariton County.

Location. -- Wire-weight gage, lat. $39^{\circ}38'$ long. $93^{\circ}05'$ on line between NW 1/4 sec. 31, T. 56 N., R. 19 W., and NE 1/4 sec. 36, T. 56 N., R. 20 W., at bridge on State Highway 11, 2 1/2 miles southwest of Rothville and 3 miles downstream from East Yellow Creek. Datum of gage is 664.37 feet above mean sea level, datum of 1929. Chain gage at same site and datum used April 1929 to June 1932.

Drainage Area. -- 405 square miles (revised).

Records Available. -- April 1929 to June 1932, October 1948 to September 1949.

Extremes. -- 1929-32, 1948-49: Maximum discharge, 7,4000 second-feet November 25, 1931, June 3, 1949; maximum gage height 21.19 feet June 3, 1949; minimum daily discharge, 0.2 second-foot October 1-4, 25-28, 30, 31, 1948.

Maximum stage know, 23.1 feet in June 1947, from floormark, from information by Corps of Engineers and local residents.

Remarks. -- Records fair except those below 10 second-feet and those for periods of ice effect or no gage-height record, which are poor.

Cooperation. -- Station maintained by U. S. Geological Survey in Cooperation with Corps of Engineers.

Chariton River near Keytesville

Location. -- Wire-weight gage, lat. $39^{\circ}26'55''$, long. $92^{\circ}52'10''$, in SE 1/4 SE 1/4 sec. 25, T. 54 N., R. 18 W., at country highway bridge, 4 1/4 miles northeast of Keytesville and 5 1/4 miles upstream from Puzzle Creek. Datum of gage is 616.37 feet above mean sea level, datum of 1929.

Drainage Area. -- 1,950 square miles.

Average Discharge. -- 20 years, 1,034 second-feet.

Records Available. -- April 1929 to September 1949.

Extremes. -- 1929-49: Maximum discharge, 25,600 second-feet June 8, 9, 1947 (gage height, 25.3 feet, from floodmarks); minimum, 4.6 second-feet Aug. 7, 9, 10, 1934.

Remarks. -- Records, in general, are fair except those periods of ice effect, which are poor.

Cooperation. -- Station maintained by U. S. Geological Survey in cooperation with Corps of Engineers.

Mussel Fork near Musselfork

Location. -- Wire-weight gage, lat. $39^{\circ}31'$, long. $92^{\circ}57'$, in SW $1/4$ SE $1/4$ sec. 32, T. 55 N., R. 18 W., at bridge on State Highway 5, $1\ 1/2$ miles upstream from Long Branch and $4\ 1/2$ miles southwest of Musselfork.

Drainage Area. -- 267 square miles.

Records Available, October 1948 to September 1949.

Extremes. -- 1948-49: Maximum discharge, 2,460 second-feet June 3, 1949 (gage height, 18.4 feet, from graph based on gage readings); minimum daily, 0.2 second-foot Oct. 1-4, 25-29, 31, 1948.

Maximum stage known, 20.7 feet in June 1947, from information by local resident.

Remarks. -- Records fair except those for periods of ice effect and no gage-height record, which are poor.

Cooperation. -- Station maintained by U. S. Geological Survey in cooperation with Corps of Engineers.

QUALITY OF WATER FROM GLACIAL DRIFT

In general, the water from the glacial drift is high in total iron, total dissolved solids, and sulfates. The iron content in the water may cause staining of plumbing fixtures and laundry; however, relatively inexpensive water treatment for the iron will prevent this staining. For most types of irrigation, total dissolved solids should not exceed 2000 parts per million and total alkalies should not exceed 75 percent. Most people cannot tolerate water for drinking purposes which contains more than 1500 parts per million of chloride, or 2000 parts per million sulfate. Water with 300 parts per million of chloride taste salty to some people. Sulfates in excess of 500 parts per million may have a laxative effect when first used for drinking.

One of the samples of water as shown by one of the following analyses contained excessive nitrates. The following is quoted from the article, The Public Health Significance of High Nitrate Waters As a Cause of Infant Cynosis and Methods of Control, Metzler, D. F., and Staltenberg, H. A., Trans. Kansas Acad. Scie. Vol. 53, No. 2, p. 194 and 205, 1950.

"The cyonosis of infants can be caused by the ingestion of nitrates in the water used for making the feeding formula. The nitrates are converted to nitrites and absorbed by the blood, where they destroy its oxygen-carrying properties. The blood becomes chocolate brown, the skin develops a blue color and death may result from oxygen starvation." "Nitrate concentrations exceeding 10 to 20 ppm of nitrate nitrogen are considered unsafe."

The following are nine water analyses from glacial drift wells.

CONSTITUENTS	IN PARTS PER MILLION				
	1	2	3	4	5
Turbidity	3	0.4	3	ferric	60
Odor	none		none	none	none
pH	7.6	7.1	6.8	7.1	7.6
Alkalinity (CaCO ₃)	346.5	324.0	217.5	201.0	400.5
Phenolphthalein	14.0	0	0.0	0.0	12.0
Methyl Orange	332.5	324.0	217.5	201.0	388.5
Carbonate (CO ₃)	8.4	0	0.0	0.0	7.2
Bicarbonate (HCO ₃)	405.7	395.0	265.3	245.2	474.0
Silica (SiO ₂)	14.7	12.0	25.8	7.5	8.8
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	0.5		0.4	3.5	0.5
Calcium (Ca)	58.3	76.5	59.4	529.0	34.9
Magnesium (Mg)	22.5	20.3	11.9	153.9	12.7
Sodium (Na) and Potassium(K) as Na	144.4	71.7	42.1	374.5	189.6
Total Manganese (Mn)	0.03		0.75		0.05
Total Iron (Fe)	0.54	0.08	0.34	3.80	4.25
Dissolved Iron	0.05		0.08		0.04
Precipitated Iron	0.49		0.26		4.21
Sulfate (SO ₄)	33.2	27.6	24.9	272.0	6.4
Chloride (Cl)	103.0	72.4	3.8	562.5	77.0
Nitrate (NO ₃)	1.5	0.53	4.4	1014.	1.6
Fluoride (F)	0.3		0.3	0.1	1.0
Total Suspended Matter	12.		5.		46.
Total Dissolved Solids	576.	541.0	307.	3898.	561.
Total Hardness	238.2	274.0	197.3	1954.5	139.5
Carbonate Hardness	238.2	274.0	197.3	201.0	139.5
Non-carbonate Hardness	0.0	0.0	0.0	1753.5	0.0
Percent of Alkalies	57	36	32	29	75

1. Owner: F. D. Miller, NE 1/4 NW 1/4 SW 1/4 sec. 2, T. 55 N., R. 21 W. Total depth 139 feet (?). Temperature of water 58° F., of the air 78° F. Sample collected April 18, 1957. Analyst: M. E. Phillips.

2. Owner: City of Mendon, Well number 1. Sampled June 26, 1956. Analyses by Missouri Division of Health.

3. Owner: N. W. School, SW 1/4 SW 1/4 SE 1/4 sec. 10, T. 55 N., R. 20 W. Total depth 42 feet. Sampled April 22, 1957 from pressure system. Analyst: M. E. Phillips.

4. Owner: C. A. Felt, sec. 10, T. 55 N., R. 20 W. Total depth 38 feet. Sample collected July 2, 1956. Analyst: M. E. Phillips.

5. Owner: Leslie Chapman, NE 1/4 SE 1/4 NE 1/4 sec. 12, T. 55 N., R. 20 W. Glacial drift? well 170 feet deep. Sampled April 22, 1957. Temperature of water 58° F., of the air 79° F. Analyst: M. E. Phillips.

CONSTITUENTS	IN PARTS PER MILLION			
	6	7	8	9
Turbidity	50.0	5.0	6	35.0
Odor			none	
pH	6.8	7.4	7.4	6.7
Alkalinity (CaCO ₃)	271.0	193.0	342.0	305.0
Phenolphthalein	0	0	0.0	0
Methyl Orange	271.0	193.0	342.0	305.0
Carbonate (CO ₃)	0	0	0.0	0
Bicarbonate (HCO ₃)	329.9	235.8	417.2	371.4
Silica (SiO ₂)	16.0	16.0	18.5	16.0
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)			0.7	
Calcium (Ca)	93.4	59.5	84.2	81.6
Magnesium (Mg)	23.3	19.9	27.8	18.5
Sodium (Na) and Potassium (K) as Na	36.0	247.2	116.5	31.1
Total Manganese (Mn)			0.52	
Total Iron (Fe)	7.5	2.0	0.54	8.0
Dissolved Iron			0.09	
Precipitated Iron			0.45	
Sulfate (SO ₄)	49.0	75.7	31.6	12.3
Chloride (Cl)	51.6	385.0	132.0	20.2
Nitrate (NO ₃)	0.89	0.44	0.1	0.4
Fluoride (F)			0.4	
Total Suspended Matter			14.	0
Total Dissolved Solids	523.0	850.0	612.	411.0
Total Hardness	329.0	230.5	324.7	280.0
Carbonate Hardness	271.0	193.5	324.7	280.0
Non-carbonate Hardness	58.0	37.0	0.0	0.
Percent of Alkalies	19	70	44	19

6. Owner: City of Brunswick. Sample collected February 1, 1956 direct from well number 2. Analyses by Missouri Division of Health.

7. Owner: City of Keytesville. Sampled June 21, 1956 from pump tap, well number 1, chlorinated. Analyses by Missouri Division of Health.

8. Owner: Clarence Ginter, SE 1/4 SW 1/4 SW 1/4 sec. 2., T. 53 N., R. 17 W. Total depth 178 feet. Sampled April 19, 1957 direct from pump. Temperature of the water 58° F., of the air 75° F. Analyst: M. E. Phillips.

9. Owner: City of Salisbury. Collected August 28, 1956. Raw water from all four wells. Analyses by the Missouri Division of Health.

QUANTITY OF WATER FROM GLACIAL DRIFT

DOMESTIC WELLS - Included in this category are wells developed for household or general farm use. Yields required from domestic wells vary but seldom exceed 15 gallons per minute. In some parts of Chariton County sands and gravels were not deposited in the glacial drift. There are also areas where the glacial drift cover is relatively thin or lacking. In such areas the possibility of developing wells is limited. Plate 1 shows the area most favorable for the development of domestic wells. Plate 3 is a contour map showing the elevation of bedrock above sea level. To determine probable drilling depths, the elevation of the bedrock should be subtracted from the surface elevation for each specific site. Plate 3 shows the locations of the test holes and the thickness of the glacial drift encountered.

IRRIGATION WELLS - Included in this category are all high yield wells whether used by cities, by industries, or for irrigation. Plate 2 shows the area most favorable for the development of irrigation wells. With proper development, yields of 200-1000 gallons per minute may be obtained. Yields to be expected are contingent upon several factors:

- (1) The thickness of the sand and gravel beds.
- (2) The size and sorting of the sand and gravel.
- (3) The manner of construction and materials used, such as proper well screen, gravel pack, etc.)
- (4) Ability of the well driller to develop the full capacity of the water bearing sands.

Continued successful production is contingent upon:

- (1) Re-charge rate of the water-bearing horizons.
- (2) Quality of the screen and materials used.
- (3) Subsequent well treatment such as acidizing.
- (4) Avoidance of over-pumpage.





MAP OF
CHARITON COUNTY
SHOWING
AREA MOST FAVORABLE FOR THE
DEVELOPMENT OF WELLS IN DRIFT

BY
DALE L. FULLER
JAMES MARTIN
HARRY PICK
W. B. RUSSELL
J. S. WELLS

1957
MISSOURI GEOLOGICAL SURVEY
AND WATER RESOURCES
ROLLA, MISSOURI

THOMAS R. BEVERIDGE
STATE GEOLOGIST

LEGEND

-  Area most favorable
-  Location of wells in drift from which water was analyzed
-  Water sample analyzed from a "rock" well
-  Water sample analyzed from a stream

Base by the Missouri
State Highway Department, 1956

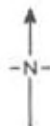
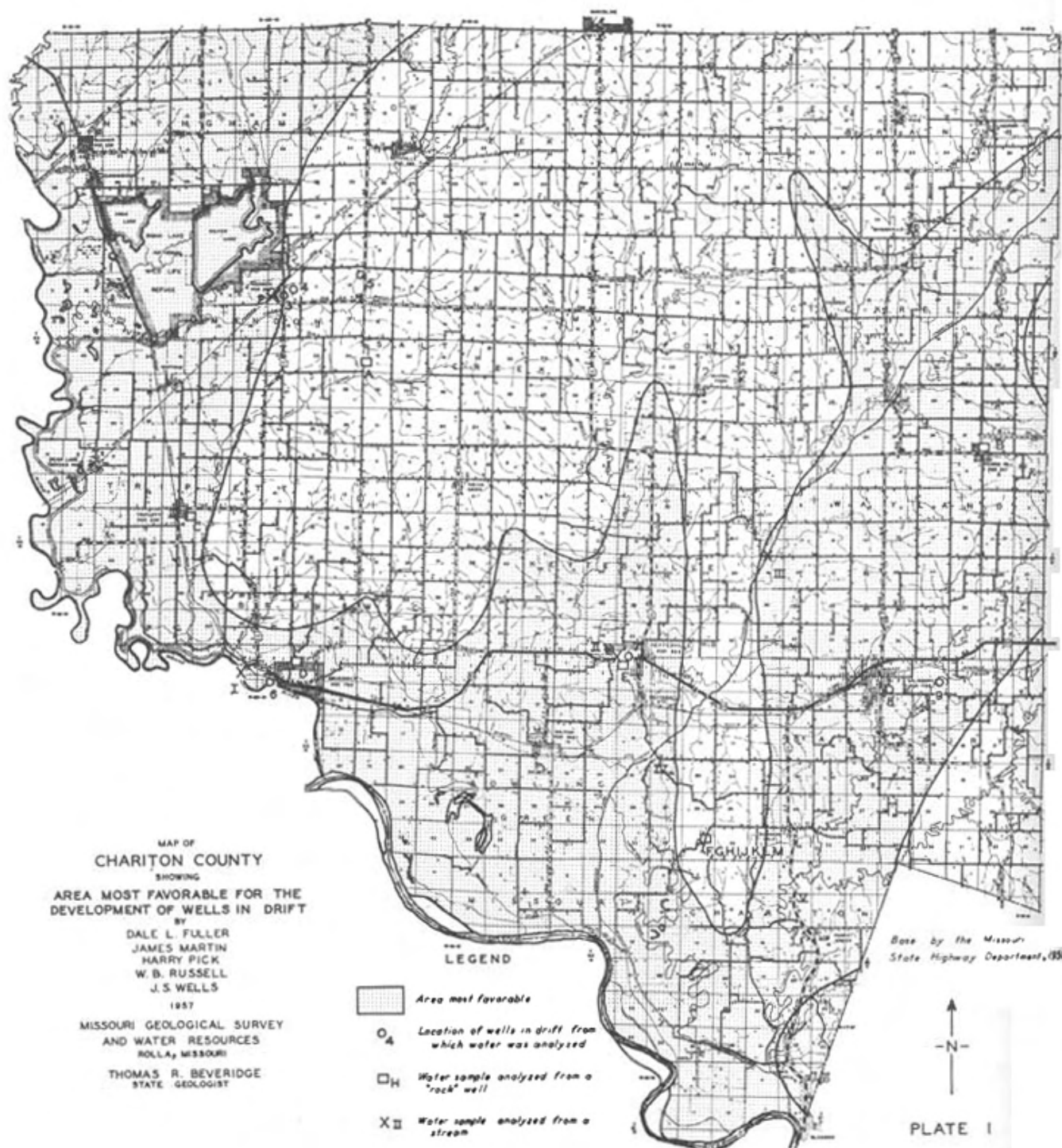
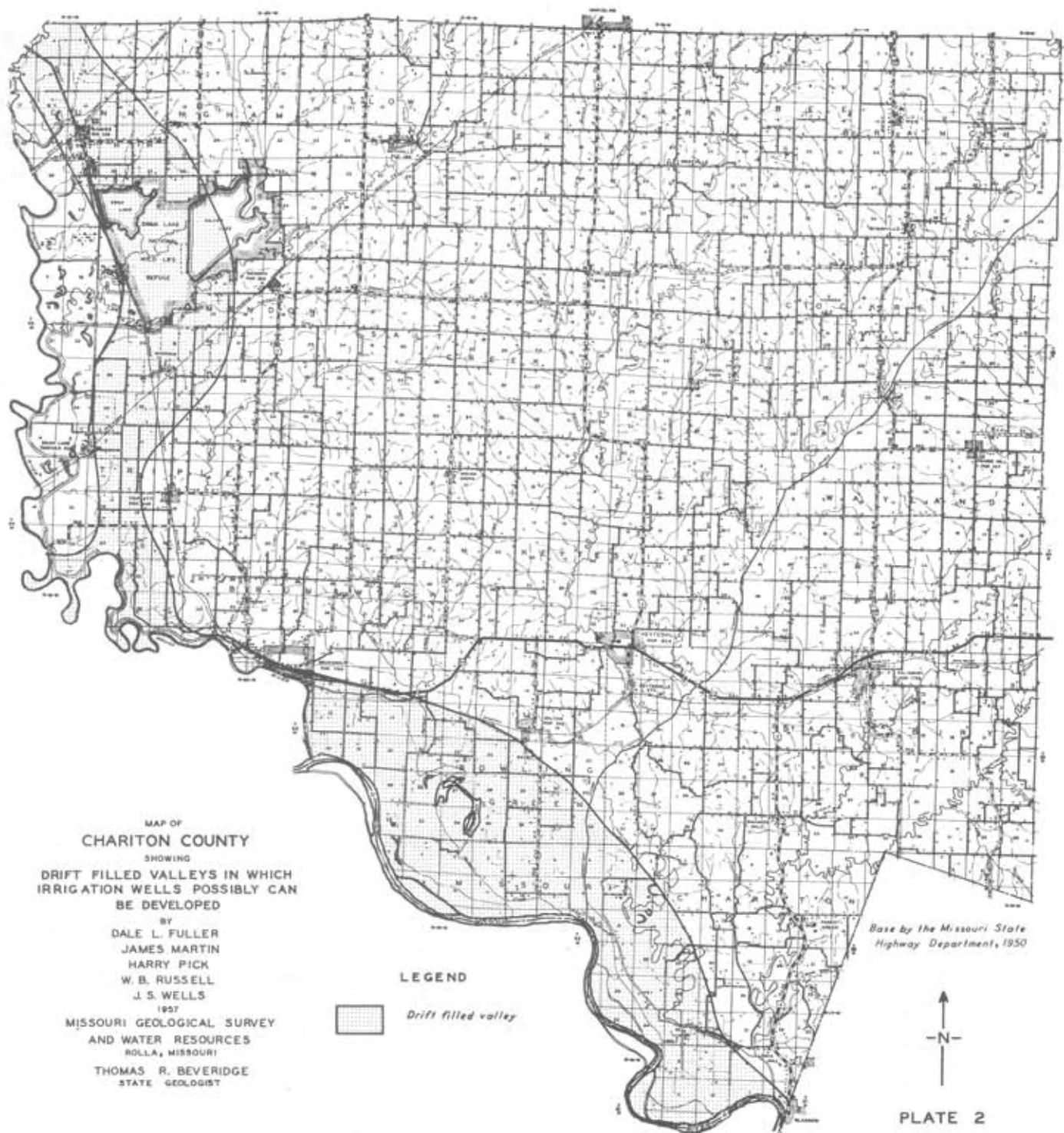
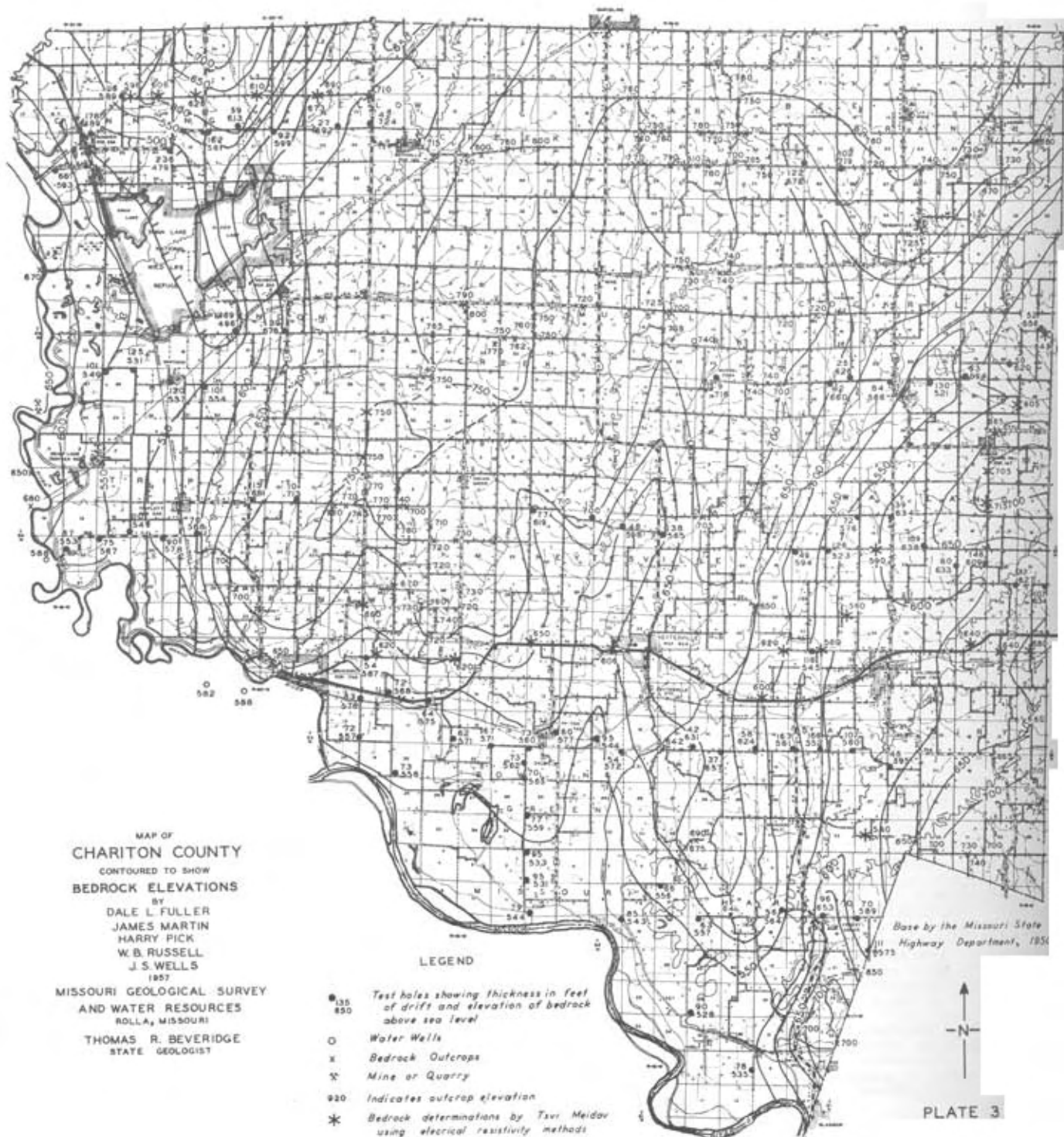


PLATE I







SUMMARY

Approximately 65,000 acres of Chariton County are located within the area in which irrigation wells possibly can be developed. Approximately three-fifths of Chariton County's area is suitable located for obtaining water sufficient for domestic needs from the glacial drift.

Questions concerning water problems for a specific location should be sent to the Missouri Geological Survey, Rolla, Missouri.